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## Analysis of the barriers for implementing green supply chain management (GSCM) Practices: An Interpretive Structural Modeling (ISM) Approach

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### Abstract

Green Supply Chain Management (GSCM) has received more attention in the last few years in academia and industries. As customers are becoming more environmental conscious and governments are making stricter environmental regulations, the industries need to reduce the environmental impact of their supply chain and the requirement of GSC increased. The main aim of this paper is to determine the relationship among the barriers and to identify the most influential barriers from the recommended barrier list with the help of interpretive structural modelling. Classification of barriers has been carried out based upon dependence and driving power with the help of MICMAC analysis. A structural model of barriers to implement GSCM in Indian industry has also been put forward using Interpretive Structural Modelling (ISM) technique. The study has been conducted in three different phases: identification of barriers from the literature, interviews with various department managers. Twenty numbers of relevant barriers have been identified. Out of which, nineteen numbers of barriers have been identified as linkage variables; one number of barriers have been identified as the driver variables and no barriers have been identified as the dependence variables. No barrier has been identified as autonomous variable. Eight barriers have been identified as top level barriers and one bottom level barrier. Clear understanding of these barriers will help organizations to prioritize better and manage their resources in an efficient and effective way. The contribution by this work is to identify the barriers to implement GSCM in Indian industry and to prioritize them. The proposed structured model developed will help to understand interdependence of the barriers.

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**Keywords:** Interpretive structural modelling (ISM); green supply chain management; barriers to implement GSCM.

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### 1. Introduction

With increasing awareness of environmental protection worldwide, the green trend of conserving the earth's resources and protecting the environment is overwhelming, thereby exerting pressure on corporations. Along with the rapid change in global manufacturing scenario, environmental and social issues are becoming more important in managing any business. Green supply Chain Management (GSCM) is an approach to improve performance of the process and products according to the requirements of the environmental regulations [1]. "GSCM is an important organizational

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philosophy, plays an important role in promoting efficiency and synergy between partners, facilitating environmental performance, minimal waste, while it improves the ecological efficiency of organizations and their partners". The objective of this work is to identify various barriers to implement GSCM in Indian auto component manufacturing industry, to identify the most dominant barrier among the selected barriers and investigate the imperative and mutual relationship of the twenty barriers for the implementation of GSCM, to classify these barriers depending upon their driving and dependence power and finally to develop ISM based model of these barriers. ISM is a well-established technique for identifying relationship among specific elements which define problem or an issue [2].

## **2. Green supply chain management (GSCM)**

A concept of supply chain management (SCM) as "evolved around a customer-focused corporate vision, which drives changes throughout a firm's internal and external linkages and then captures the synergy of inter-functional, inter-organizational integration and coordination" [3]. A green supply chain aims at confining the wastes within the industrial system in order to conserve energy and prevent the dissipation of dangerous materials into the environment [4]. It recognizes the disproportionate environmental impact of supply chain processes within an organization. GSCM is the summing up of green purchasing, green manufacturing, green packing, green distribution and marketing. GSCM is to eliminate or minimize waste in the form of hazardous, chemical, energy, emission and solid waste [5]. Interpretive structural modelling (ISM) technique was utilized to understand the mutual influences among the barriers so that those driving barriers, which can aggravate few more barriers and those independent barriers, which are mostly influenced by driving barriers are identified [6]. ISM based model for greening the supply chain in Indian manufacturing industries was explained. ISM based model for modelling the barriers of green supply chain practices in Indian manufacturing industries was put forward. The concerned managers in the industry feel that, green businesses practices are not so easy to adopt and implement due to the presence of many barriers in Indian business environment. A questionnaire based survey has been conducted to analyze and ranking these barriers. Finally, twenty barriers were identified. ISM methodology has been used to model and analyze key barriers [7].

## **3. Barriers to implement GSCM practices in Indian auto component manufacturing industry**

According to world statistics, the automobile industry is world's largest single manufacturing sector [8]. The growth in the world's population has also increased the demand for the automobile [5]. The demand of automobiles such as cars, bikes and commercial vehicles in India has been increased in last decade, therefore leading international and domestic automobile are either setting up their new manufacturing plants or increasing their production capacity in their existing plants in India. We have identified various barriers to implement GSCM concept in Indian industry from the literature reviews and expert opinions. Literature has been reviewed to identify barriers to implement GSCM concept in Indian auto component manufacturing industry. We conducted a brainstorming session, in which two experts from academia and three experts from industry were invited. Brainstorming session was conducted and twenty barriers relevant to Indian industry were identified. These barriers to implementation of GSCM in Indian auto component manufacturing industry are discussed in table 1.

## **4. Application of Interpretive structural modeling (ISM) for implementation of GSCM**

Interpretive Structural Modelling (ISM) is a methodology used to identify relationship among specific elements, which define a problem or issue. ISM is an interactive learning process in which a set of dissimilar and directly related elements are structured into a comprehensive systematic model. The model so formed, portrays the structure of a complex issue or problem, a system or a field of study, in a carefully designed pattern implying graphics as well as words. The basic idea of ISM is to use experts' practical experience and knowledge to construct a multilevel structural model; it was firstly developed in 1970's [2, 22].

ISM generally has following steps [6]:

**Step 1.** Variables (criteria) considered for the system under consideration are listed.

**Step 2.** From the variables identified in step 1, a contextual relationship is established among the variables in order to Identify as to which pairs of variables should be examined.

**Step 3.** A structural self-interaction matrix (SSIM) is developed for variables, which indicates pair wise relationships

among variables of the system under consideration.

Table 1 Description of green supply chain management barriers

S. No.	Barriers	Sources
1.	Cost Implication	[9]
2.	Lack of IT applications	[6,9]
3.	Poor organizational culture in adopting GSCM	[1,6]
4.	Lack of Top management commitment in adopting GSCM	[6,10,11]
5.	Resistance to advance technology adoption	[12,13]
6.	Lack of government support to adopt GSCM	[9,14]
7.	Lack of knowledge about green practice	[1,6]
8.	Lack of Technical expertise	[15,16]
9.	Market competition	[17]
10.	Less awareness of customer about GSCM	[18]
11.	Lack of environmental awareness to the supplier	[19]
12.	Fear of failure	[15,16]
13.	Pollution/Wastage in industries	Our contributed barrier
14.	Non-availability of bank loans to encourage green product	Our contributed barrier
15.	Lack of training courses about implementing GSC	[20]
16.	Lack of recycling and reuse efforts of organization	Our contributed barrier
17.	Lack of sustainability certification (ISO 14001)	[18]
18.	Cost of disposal of hazardous products	Our contributed barrier
19.	Lack of awareness about reverse logistics adoption	[6]
20.	Lack of corporate social responsibility	[7,21]

**Step 4.** Reachability matrix is developed from the SSIM and the matrix is checked for transitivity. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a variable A is related to B and B is related to C, then A is necessarily related to C.

**Step 5.** The reachability matrix obtained in step 4 is partitioned into different levels.

**Step 6.** Based on the relationships given above in the reachability matrix, a directed graph is drawn and the transitive links are removed.

**Step 7.** The resultant digraph is converted into an ISM, by replacing variable nodes with statements.

**Step 8.** The ISM model developed in step 7 is reviewed to check for conceptual inconsistency and necessary modifications are made. The above steps are shown in Fig. 1.

#### 4.1. Data gathering methodology and structural self-interaction matrix

To analyse the barriers for the adoption of Green Supply Chain Management in industry, twenty barriers were considered. From the literature sixteen important barriers were taken and after brain storming session with industrial

experts four barriers were added. These experts were senior managers for industry and senior faculty of academics. In developing SSIM, following four symbols have been used to denote the direction of relationship between two barriers  $i$  and  $j$ .

V- Barrier  $i$  will lead to barrier  $j$ ;

A- Barrier  $j$  will lead to barrier  $i$ ;

X- Barrier  $i$  and  $j$  will lead to each other;

O- Barrier  $i$  and  $j$  are unrelated

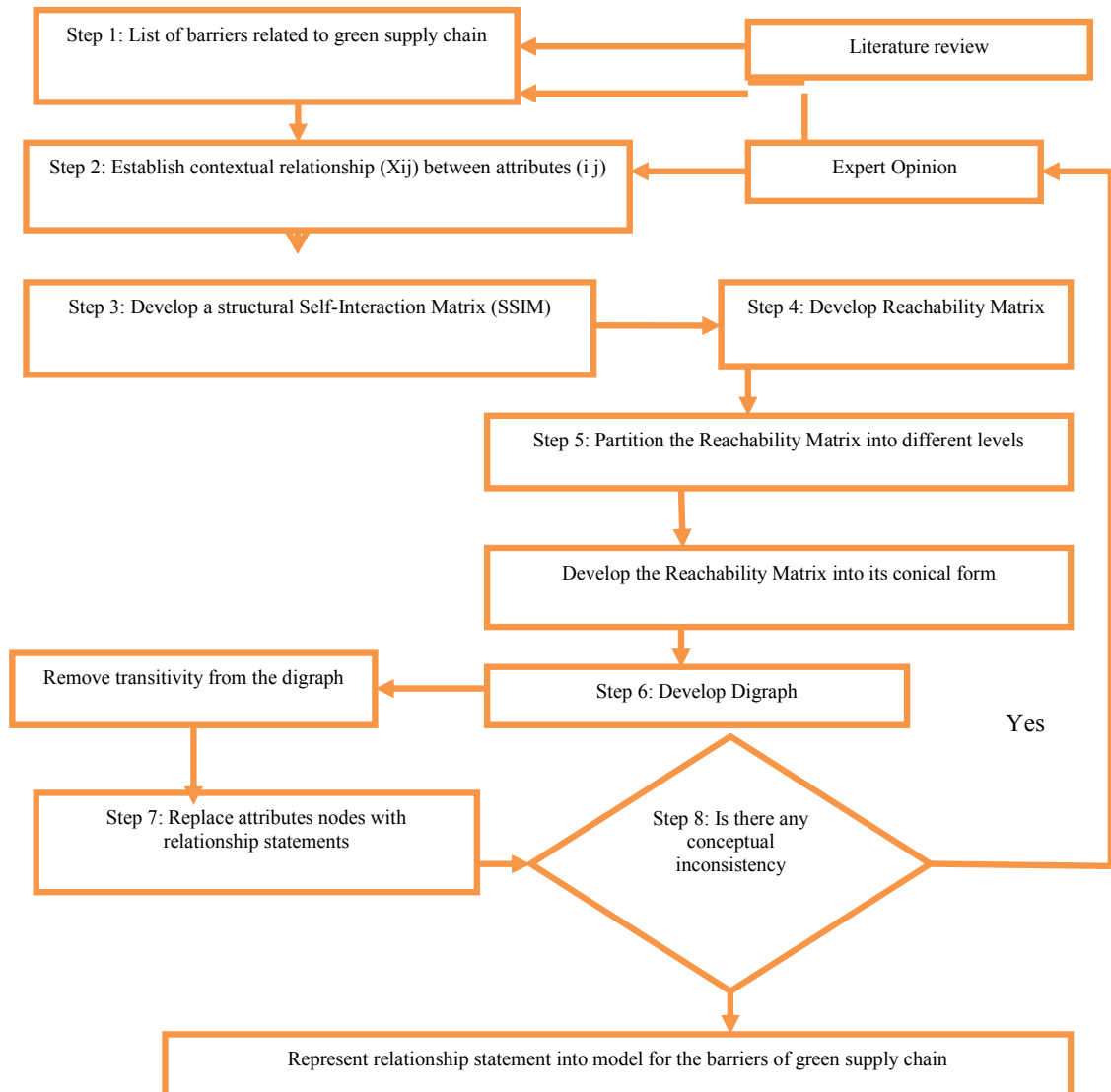


Figure 1 Flow diagram for preparing the ISM model

Based on the contextual relationships, the SSIM has been developed (Table 2). Barrier 1 leads to barrier 7 so symbol 'V' has been given in the cell (1,7); barrier 11 leads to barrier 2 so symbol 'A' has been given in the cell (2, 11); barrier 5 and 8 lead to each other so symbol 'X' has been given in the cell (5,8); barrier 3 and 14 do not lead to each other so symbol 'O' has been given in the cell (3,14) and so on. The number of pair wise comparison question addressed for developing the SSIM are  $(N) * (N-1)/2$ , where  $N$  is the number of barriers.

Table 2. Structured Self Intersection Matrix (SSIM) for Barriers to Implement GSCM in Indian auto component manufacturing industry

Barriers	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	O	A	A	O	V	O	V	A	O	O	X	A	O	V	A	A	O	V	A	X
2	O	O	A	V	V	V	O	O	V	A	O	O	X	V	O	V	A	O	X	
3	V	V	O	O	A	A	O	V	V	V	O	V	X	V	A	A	A	X		
4	V	V	O	O	V	A	O	X	V	V	O	O	A	V	A	V	X			
5	O	A	A	O	V	A	A	V	V	X	X	V	X	V	A	X				
6	V	O	V	V	V	V	O	V	V	A	V	O	V	V	X					
7	O	O	X	V	X	A	O	V	O	X	X	X	A	X						
8	V	O	A	O	V	O	O	O	A	A	V	V	X							
9	O	A	A	O	A	A	O	A	O	A	O	X								
10	X	O	A	O	V	V	A	O	A	O	X									
11	V	V	V	V	V	V	V	V	V	X										
12	O	V	A	A	O	A	V	O	X											
13	O	O	X	A	A	A	A	X												
14	O	O	O	V	V	O	X													
15	O	O	A	O	V	X														
16	V	O	V	V	X															
17	O	A	A	X																
18	V	A	X																	
19	V	X																		
20	X																			

In this step, the reachability matrix is developed from SSIM. The SSIM format is initially converted into an initial reachability matrix format by transforming the information of each cell of SSIM into binary digits (i.e. ones or zeros) in the initial reachability matrix by substituting V, A, X, O by 1 or 0 applying following rules:

- If (i, j) value in the SSIM is V, (i, j) value in the reachability matrix will be 1 and (j, i) value will be 0; for V(1,7) in SSIM, '1' has been given in cell(1,7) and '0' in cell(7,1) in initial reachability matrix.
- If (i, j) value in the SSIM is A, (i, j) value in the reachability matrix will be 0 and (j, i) value will be 1; for A(2,11) in SSIM, '0' has been given in cell(2,11) and '1' in cell(11,2) in initial reachability matrix.
- If (i, j) value in the SSIM is X, (i, j) value in the reachability matrix will be 1 and (j, i) value will also be 1; for X(5,8) in SSIM, '1' has been given in cell(5,8) and '1' in cell(8,5) also in initial reachability matrix.
- If (i, j) value in the SSIM is O, (i, j) value in the reachability matrix will be 0 and (j, i) value will also be 0; for O(3,14) in SSIM, '0' has been given in cell(3,14) and '0' in cell(14,3) also in initial reachability matrix.

#### 4.2. Initial Reachability matrix

Initial Reachability Matrix for barriers to implement GSCM in Indian auto component manufacturing industry shown in table 3.

#### 4.3. Final reachability matrix with driving and dependence power

The final reachability matrix has been obtained by adding transitivity as explained in Step 4 earlier. It is a basic assumption made in ISM. Final Reachability Matrix with driving power and the dependence power of each barrier have also been shown in the Table 4.

#### 4.4. Partitioning of levels

The reachability and antecedent set [22] for each barrier have been determined from the final reachability matrix. The reachability set for a barrier consists of the barrier itself and the other barriers, which it influences.

Table 3 Initial Reachability Matrix for Barriers to Implement GSCM in Indian auto component manufacturing industry

Barriers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0
2	1	1	0	0	1	0	1	1	0	0	0	1	0	0	1	1	1	0	0	0
3	0	0	1	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	1	1
4	0	1	1	1	1	0	1	0	0	0	1	1	1	0	0	1	0	0	1	1
5	1	0	1	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	0	0
6	1	0	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1
7	0	0	0	0	0	0	1	0	1	1	1	0	1	0	0	1	1	1	0	0
8	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1
9	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
10	1	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1
11	0	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
12	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0
13	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0
14	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	1	0	0	0
15	0	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	0	0	0	0
16	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	1	1	0	1
17	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0
18	1	1	0	0	1	0	1	1	1	1	0	1	1	0	1	0	1	1	0	1
19	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1
20	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1

The antecedent set consists of the barrier itself and other barriers, which may influence it. Reachability and antecedent set and Intersection sets are found for the all barriers shown in table 5. We have identified three levels in our study. But fourth level is given to lack of government support policies because its driving power is very high than other barriers.

#### 4.5. ISM model formulation

From the final reachability matrix in Table 4, from the final reachability matrix, the structural model is generated and is given in Fig. 2. Removing the transitivity's as described in the ISM methodology, the digraph is converted into the ISM model has been made as shown in Figure 2.

#### 4.6. Application of MICMAC Analysis for barriers classification

Variables are classified in to four clusters [23] named as autonomous variables, dependent variables, linkage variables and independent variables. The MICMAC principle is based on multiplication properties of matrices. The purpose of MICMAC analysis is to analyze the drive power and dependence power of barriers

The purpose of MICMAC analysis is to analyse the drive power and dependence power of barriers.

1. Autonomous variables (first cluster) have weak driving power and dependence. These variables can be disconnected from the system. In our study, no barrier lies in this range.

2. The second cluster is named dependent variables. They have weak driving power and strong dependence power. In our study, no barrier lies in this range.

3. The third cluster named linkage variables having strong driving power and strong dependence power. In our study, nineteen barriers lies in this region named as Cost Implication, Lack of IT applications, Poor organizational culture in adopting GSCM, Lack of Top management commitment in adopting GSCM, Resistance to advance technology adoption, Lack of knowledge about green practice, Lack of Technical expertise, Market competition, less awareness of customer about GSCM, Lack of environmental awareness to the supplier, Fear of failure, Pollution/Wastage of

industries, Non-availability of bank loans to encourage green product, Lack of training courses about implementing GSCM, Lack of recycling and reuse efforts of organization, Lack of sustainability certification (ISO 14001), Cost of disposal of hazardous products, Lack of awareness about reverse logistics adoption, Lack of corporate social responsibility.

4. The fourth cluster named independent variables has strong driving power and weak dependence power. In our study, one barrier named Lack of government support systems (6) are lying in this range. The graph between dependence power and driving power for the barriers to implement GSCM in Indian auto component manufacturing industry is given in Figure 3. The aim of this study is to analyse the driving power and the dependency power of barriers [24]. Without analysing the barriers we cannot start the implementation of successful Green Supply Chain Management in Indian firms. In this case, barriers hindering the implementation of GSCM which were obtained from consultation with experts and literature have been put into an ISM to analyse the interactions between these barriers. This analysis of barriers makes GSCM adoption easy by removing the dominant barrier in steps. Higher dependence values for a factor means a large number of barriers to be addressed before its removal and high driving value of a barrier means a large number of barriers that could be removed by its removal.

Table 4 Final Reachability Matrix with driving and dependence power

Barriers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Driving Power
1	1	0	1	0	1*	0	1	1*	1*	1	1*	1	1*	1	1*	1	1*	1*	1*	1	17
2	1	1	1	1	1	0	1	1	1*	1*	1*	1	1*	1*	1	1	1	1*	1*	1	19
3	1	1	1	1	1*	1	1	1	1	1*	1	1	1	1*	1*	1*	1*	1*	1	1	20
4	1	1	1	1	1	1	1	1*	1*	1*	1	1	1	1*	1*	1	1*	1*	1	1	20
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1*	1*	1	1*	1*	1*	1	20
6	1	1	1	1	1	1	1	1	1*	1	1*	1	1	1*	1	1	1	1	1*	1	20
7	1	1	1	1	1*	1	1	1*	1	1	1	1	1	1*	1*	1	1	1	1*	1	20
8	1	1	1	1	1	0	1	1	1	1	1*	1	1*	0	1*	1	1*	1*	1*	1	18
9	1	0	1	0	0	0	1	0	1	1*	1*	0	1*	1*	0	1*	1*	1*	0	0	11
10	1	0	1	1	1	0	1	1*	1*	1	1*	1	1*	1*	1	1	1*	1*	0	1	17
11	1	1	1	1	1	1	1	1	1	1*	1	1	1	1	1	1	1	1	1	1	20
12	1	1	1	1	1*	0	1	1	1*	1	0	1	1*	1	1*	1*	1*	1*	1	1	18
13	1	1	1	1	1*	0	1	1*	1	1*	1*	1	1	1*	1*	1*	1*	1	1*	1	19
14	1	0	1	1	1	0	1	1*	1*	1	1*	1	1	1	1*	1	1	1*	0	1	17
15	1	1	1	1	1	0	1	1*	1	1	1*	1	1	0	1	1	1*	1*	1*	1	18
16	1	1	1	1	1*	0	1	1*	1	1*	1*	1	1	0	1*	1	1	1	1*	1	18
17	1	0	0	1	0	0	0	1*	1*	1*	0	1	1	1*	0	0	1	1*	1*	0	11
18	1	1	1	0	1	0	1	1	1	1	1*	1	1	1*	1	1*	1	1	1*	1	18
19	1	1	1	0	1	0	1	1*	1	1*	1*	1	1*	1*	1*	1*	1	1	1	1	18
20	0	1	0	0	1*	1	1	1*	1*	0	1	1	1*	1*	1*	1*	1*	1*	1*	1	16
Dependence Power	1	1	1	1	18	7	1	19	20	19	18	1	20	17	18	19	20	20	17	1	355/35

\*means value after applying transitivity

Table 5 First Iteration to FIND LEVELS of Barriers to Implement GSCM in Indian auto component manufacturing industry

Barriers	Reachability Set	Antecedent Set	Intersection Set	Levels
9	1,3,7,9,10,11,13,14,16,17,18	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,3,7,9,10,11,13,14,16,17,18	I
13	1,2,3,4,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20	I
17	1,4,8,9,10,12,13,14,17,18,19	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,4,8,9,10,12,13,14,17,18,19	I
18	1,2,3,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20	1,2,3,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20	I
2	2,3,4,5,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,7,8,11,12,15,16,19,20	II
5	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	II
7	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	II
8	2,3,4,5,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,7,8,11,12,15,16,19,20	II
12	2,3,4,5,7,8,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,7,8,12,15,16,19,20	II
16	2,3,4,5,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,4,5,7,8,11,12,15,16,19,20	II
19	2,3,5,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,3,5,7,8,11,12,15,16,17,19,20	II
20	2,5,6,7,8,11,12,15,16,19,20	2,3,4,5,6,7,8,11,12,15,16,19,20	2,5,6,7,8,11,12,15,16,19,20	II
1	3,4,6,11	3,4,6,11	3,4,6,11	III
3	3,4,6,11	3,4,6,11	3,4,6,11	III
4	3,4,6,11	3,4,6,11	3,4,6,11	III
10	3,11	3,4,6,11	3,11	III
11	3,4,6,11	3,4,6,11	3,4,6,11	III
14	3,4,11	3,4,6,11	3,4,11	III
15	3,4,11	3,4,6,11	3,4,11	III
6	3,4,6,11	3,4,6,11	3,4,6,11	IV

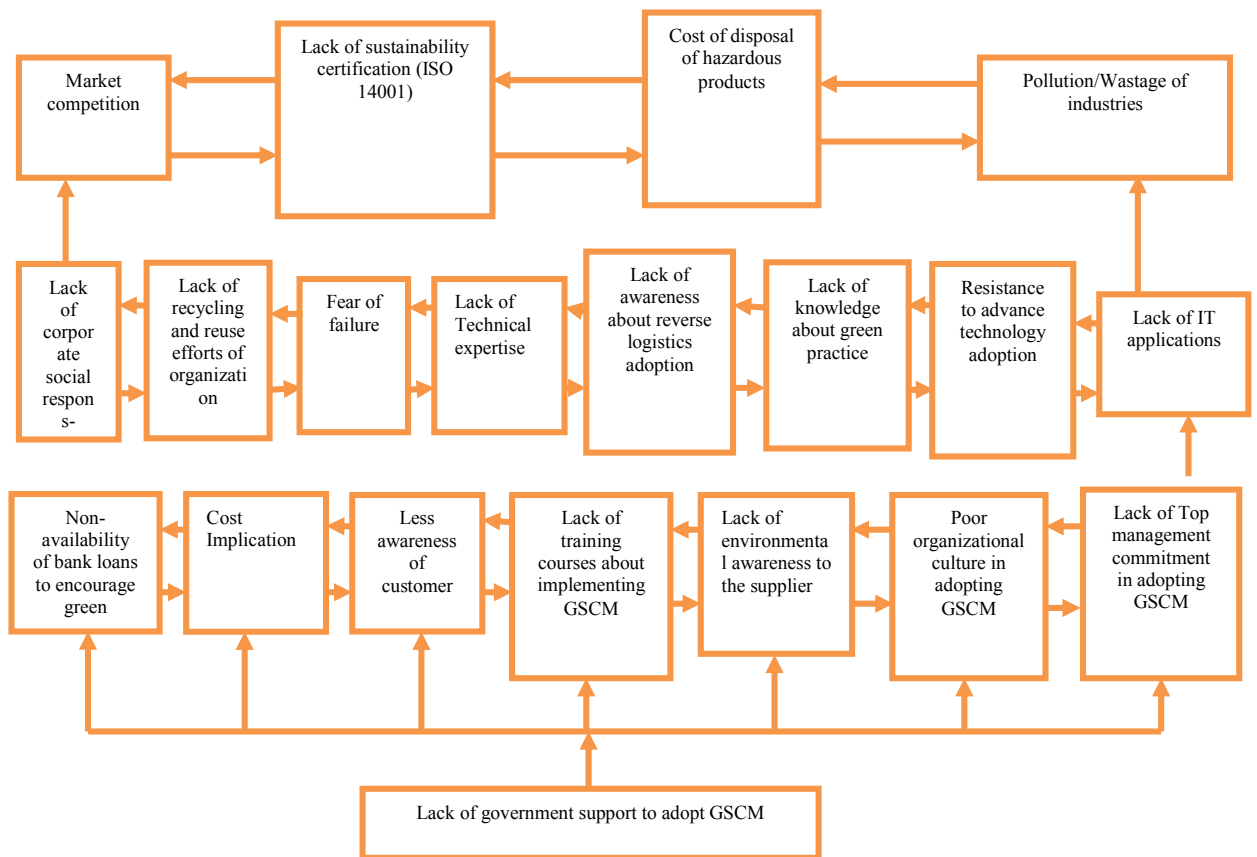


Figure 2 ISM BASED Model for barriers to implement GSCM in Indian auto component manufacturing industry



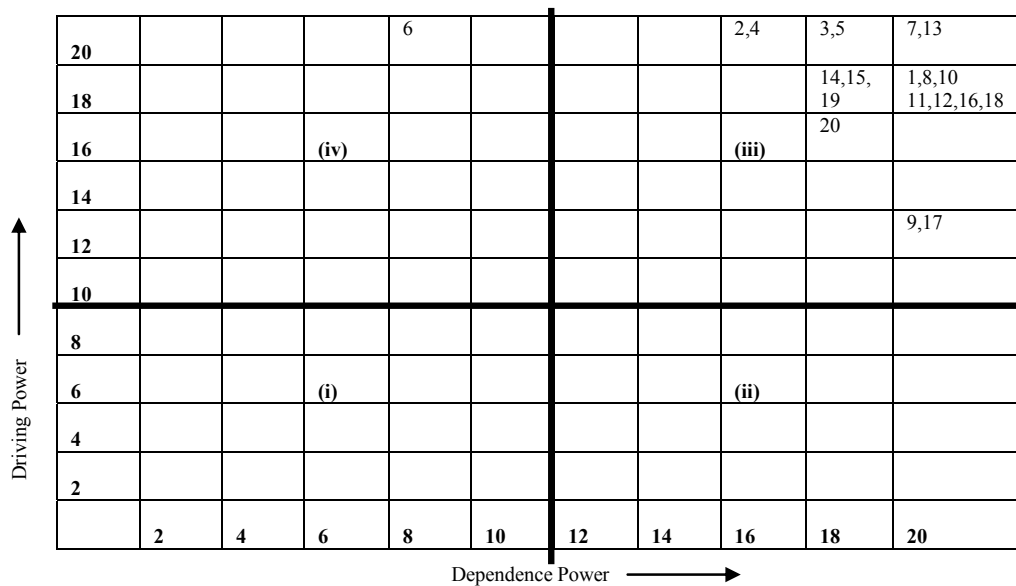


Figure 3 Cluster of Barriers to Implement GSCM in Indian auto component manufacturing industry

## 5. Results and Conclusions

The environmental image and environment consciousness of customers are increasing in the market day by day. It has pushed SMEs to think about clean and green production by implementing of GSCM. Auto component manufacturing industries play vital role in a country's economy and should begin adopting GSCM as their strategy. Twenty barriers to implement GSCM in Indian auto component manufacturing industry have been identified. Interpretive Structural Modelling (ISM) methodology has been used for finding contextual relationships among various barriers to implement GSCM in Indian auto component manufacturing industry.

A Model has been developed from ISM technique with the help of experts' opinion. Cost Implication, Lack of IT applications, Poor organizational culture in adopting GSCM, Lack of Top management commitment in adopting GSCM, Resistance to advance technology adoption, Lack of knowledge about green practice, Lack of Technical expertise, Market competition, less awareness of customer about GSCM, Lack of environmental awareness to the supplier, Fear of failure, Pollution/Wastage of industries, Non-availability of bank loans to encourage green product, Lack of training courses about implementing GSCM, Lack of recycling and reuse efforts of organization, Lack of sustainability certification (ISO 14001), Cost of disposal of hazardous products, Lack of awareness about reverse logistics adoption, Lack of corporate social responsibility have been identified as linkage variables. One barrier named as lack of government support systems has been identified as the driver variables. No barrier has been identified as autonomous variable and dependent variable. Market competition, Lack of sustainability certification (ISO 14001), Cost of disposal of hazardous products, Pollution/Wastage of industries have been identified as top level barriers and Lack of Government support systems as most dominant bottom level barrier. This barrier is at 4<sup>th</sup> level (bottom level) because its driving power is 20 and dependence power is 7. Therefore, lack of government support system is most important barrier and it is at the bottom level of the ISM model.

Indian industry has to take care about this bottom level barrier. Non-availability of bank loans to encourage green product, cost implication, less awareness of customer about GSCM, lack of training courses about implementing GSCM, lack of environmental awareness to the supplier, poor organizational culture in adopting GSCM and lack of Top management commitment in adopting GSCM have been identified as 3<sup>rd</sup> level barriers. These are also important barriers in implementing GSCM. Removal of these barriers will help in implementing GSCM in Indian auto

component manufacturing industry.

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